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Alternating Electric-Current Machines.

Electric machines for the production of to-and-fro currents, or alternating-current machines, have not been produced in this country to any considerable commercial extent. But in European countries they have been made of enormous size; and, if we are to believe all that we read about them, they have been found practically applicable to electric lighting by both arc and incandescent systems.

The first magneto-electric machines were for the production of alternating currents, and even now they are made and used for medical purposes, but no considerable industrial use had been found for them until Van Malderen and Nollet completed the famous machines for the *Société l'Alliance* to be used in the production of electric light inFrance in 1856. But these were magneto-electric machines simply; or, in other words, the field-magnets were steel permanent ones. The machines of this class were made to give their to-and-fro currents through a commutator, by which they were turned into one direction to the external circuits.

These machines were not received with much favor, and were displaced, in many cases, by the Siemens H-armature dynamos, which also produced to-and-fro currents turned in one direction by a commutator. These two kinds of electric generators gave currents which continually rose and fell in strength, as well as electromotive force, so that there were impulses, pulsations, or intermissions which were decidedly objectionable in various industrial cases.

So, when the Gramme class of machines came before the public, the older ones were mostly abandoned for the new, and, in most respects, better machines. But Jablochkoff early found in his experiments with his electric candle that continuous currents of one direction would not answer for his system, because the transference of carbon from the positive electrode of his candle required that electrode to be made twice as large as the other; and even then he failed to make the candle burn symmetrically. Therefore he returned to the alternating-current machines, because the currents from them make the carbon electrodes alternately positive and negative, so that the carbon is removed from both in like quantities.

Lontin, in France, in 1875 made one of the first electro-magneto-electric machines for the production of alternating currents to be used in lighting electric candles. This we call "electro-magneto-electric" because the field magnets, instead of being permanent magnets, were electro-magnets which were energized by an externally-produced current of electricity. Lontin's machine consisted of an iron hub mounted on a rotating axis and carrying a number, say 16, of radial iron arms which were the cores of electro-magnet coils; so that it may be said that these were so many electro-magnets which constituted the field-magnets and which were of alternate polarity. That is to say, a north pole had a south one upon each side of it on he plane of rotation, and *vice versa*.

Two metal wheels were mounted on the shaft and insulated therefrom and from each other except as they were connected by the wire which was wound upon the radial cores—one end of the wire being fastened to one wheel, and the other end to the other wheel. On these wheels two brushes bore, and they were the respective terminals of a dynamo-electric machine which was run solely to supply current to the rotating field-magnets. Concentrically with the end of these magnets, but a few inches therefrom, was placed a fixed ring upon which was radially mounted an equal number, say 16, of electro-magnets, with their poles pointing towards the axis, and as close to the rotating poles as possible and admit of rotation. These fixed electro-magnets constituted the armature of the machine, and in them, as their poles were magnetized alternately north and south by the passing before them of the field-magnets during rotation were generated currents of electricity, having a change of direction (to-and-fro) with each change in polarity. These several electro-magnets were in the various machines connected up in "parallel" or in "series" as was desired for changes in electromotive force or in intensity. In parallel the electric currents were of low electromotive force and great intensity; and in series the reverse was the case. Also, each bobbin on each core was arranged so as to have its special circuit. Many combinations could be made, as can be made of a like number of battery cells.

Though these machines attracted considerable attention at the time and great promises were made for them, they were found to be uneconomical. This want of economy seems to have been mainly because much of the mechanical energy applied to them was conserved as heat instead of utilizable electricity, by reason of the Foucault currents generated in the masses of iron of the machines.

Gramme then made some alternating-current machines in which radial field magnets were rotated within a ring, but the ring instead of having radial cores upon which the bobbins of wire were wound, as in the Lontin machine, had the bobbins wound upon the ring itself, somewhat after the manner of the well-known Gramme armature. But, instead of connecting the bobbins to a collector, the ends of them were run to the several circuits. As the rotating poles passed before the wire of the bobbins to-and-fro currents were generated in the bobbins. These Gramme alternating-current machines have not been found economical, for not only the reasons ascribed to the Lontin, but because the magnetic changes were not rapid and decided enough to confer sufficient electromotive force.

FIG. 2.

Gramme also made some machines of this type, which had combined with them on the one shaft the armature which supplied the current to excite the field magnets of the alternating-current part of the machine.

The next machine of the kind which attracted considerable attention was that made by de Meritens, in France, in 1878. This was a permanent-magnet field machine. The magnets were fixed with their poles alternating in polarity and concentrically to the axis of rotation of the armature which was a ring upon which were placed a number of flat, sector-shaped, electro-magnets. The currents to supply the circuit were taken off reversely to the manner explained as practiced in supplying the Lontin machine with its exciting current.

The Hefner-Alteneck alternating-current machine, made by Siemens & Halske, of Berlin, is the one now in most extensive use. The field magnets are fixed and are made up of two circular crowns of electro-magnets, the cores of which are placed parallel, and concentric to the axis of rotation of the armature. The poles of the two crowns point toward each other, and have opposite poles on the same line horizontally, and also on their planes. Between the sets of poles of the two crowns an armature is rotated. This armature is made up of sector-shaped bobbins of wire, but without iron cores. The wires of the bobbins are so arranged that they are radial, and in moving through the several magnetic fields formed by the two crowns of magnets cut the lines of force at right angles. The currents are taken off as in the de Meritens machine. The field-magnets are energized from a separate source of electricity, a Siemens dynamo, for instance.

The Gramme, de Meritens and Hefner-Alteneck alternating-current machines seem to be necessarily limited in size and in the number of lighting circuits they can supply. But the Lontin machine, or rather others of which the Lontin machine is the prototype, can be made, apparently, of almost any size and capacity. Such machines made after designs calculated to avoid the electrical, magnetic and mechanical defects of the original, have been made of enormous sizes in England, France and Germany, and put

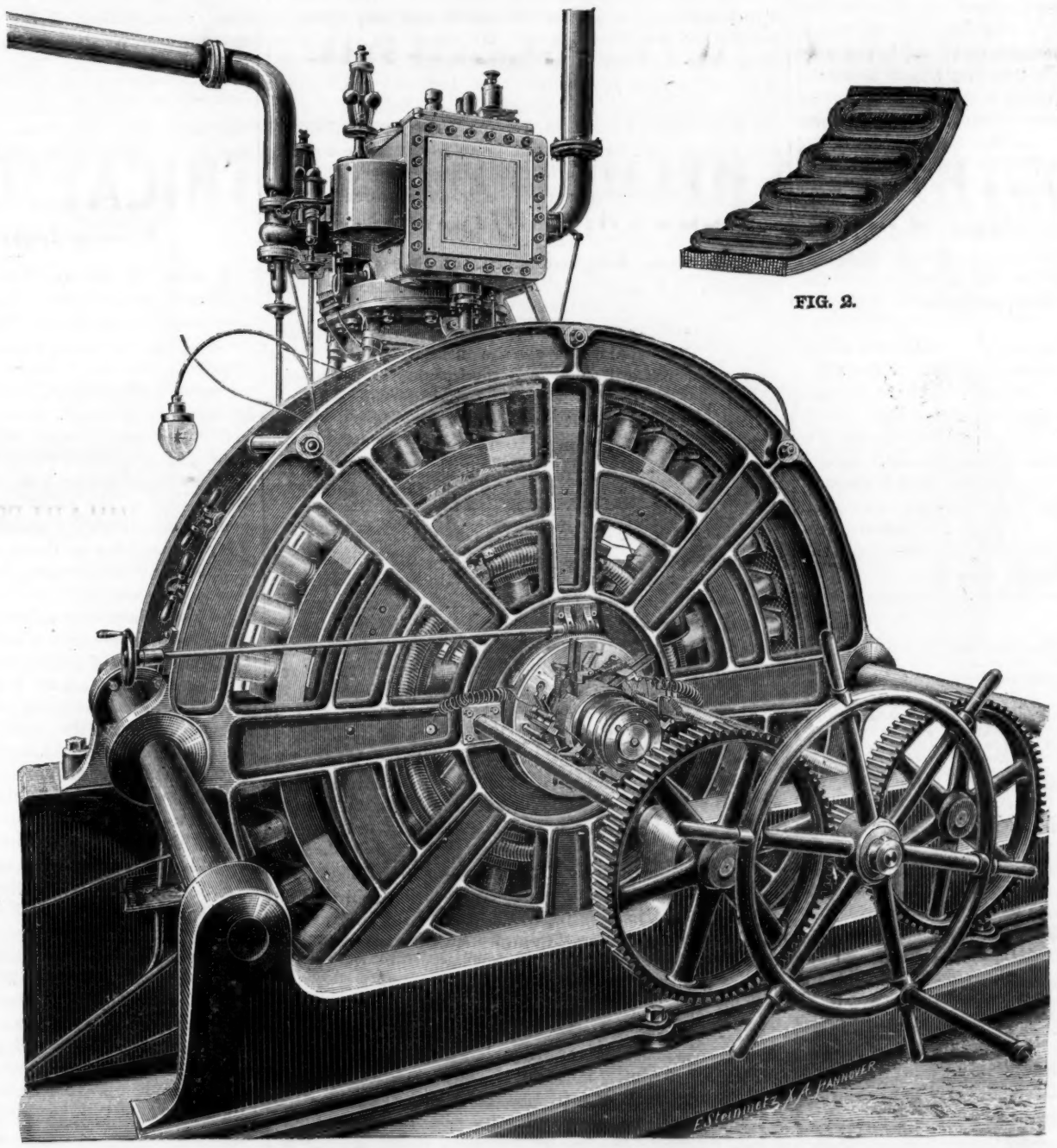

FIG. 1.—THE GANZ ALTERNATING-CURRENT MACHINE.

into practical use. Furthermore high electrical efficiency is claimed for them, as well as other excellencies. How well they will stand the tests of years and the examinations of uninterested experts remains to be seen. We do not see any reason why such machines cannot be made to economically supply currents for large central stations, provided they be made on correct mechanical principles, and be so constituted that Foucault currents are avoided as far as possible. Means for accomplishing this latter *desideratum* are well known, and used in making other classes of machines.

We give a rear view, reproduced from a recent issue of *Engineering*, of one of the arge machines, and here copy the description therein given :

"The enormous electric generator shown by Messrs. Ganz & Co., of Buda-Pesth, at the Vienna Exhibition, has now been permanently erected at the Central Station at the Hungarian States Railway at Buda-Pesth. It is to be employed to supply current for 70 arc and 600 incandescence lamps, and will form part of one of the most important and interesting installations in Austria. The machine itself and the inverted compound engine by which it is driven are illustrated on our two-page plate, the two being combined on one bed-plate, and the moving part of the generator forming the flywheel of the engine.

"The currents are alternating, and therefore the field magnets need to be separately excited. Consequently the machine consists of two separate parts, viz., an alternate current generator and an exciting dynamo, both mounted concentrically on the same shaft. The armature of the main generator is composed of a wire drum, on the inside of which there are mounted 36 induction coils, in the manner adopted by Messrs. Ganz & Co., and which is shown in the accompanying view. These are wound with wire of 3.8 mm. (.150 in.) diameter. The 36 field magnets rotating inside the armature coils form a flywheel 8 ft. 2½ in. in diameter and 18 in. wide. The fixed magnets are wound with wire .138 in. in diameter.

"The exciting machine is a six-poled Gramme ring of 3 ft. 11 in. mean diameter, revolving within 12 pairs of field magnets. The ring is wound with wire 0.98 in. in diameter, and the magnets with wire .138 in. in diameter. The commutator is 11.8 in. in diameter, and consists of 180 sectors.

"A noticeable feature of this machine is that the whole of the fixed parts—that is, the induction coils of the alternate current machine and the field magnets of the dynamo—are removable sideways to such an extent that a man may enter for the purpose of making repairs, though it is scarcely likely that this provision will be needed. To this end the fixed parts are mounted upon two stout horizontal bars, along which they can be drawn by two screws geared together and to a hand-wheel. By the aid of this arrangement one man can perform the work of removing the drum in a few minutes.

"The following are the electrical measurements in connection with this machine :

Resistance of 36 induction coils in parallel circuit	0.0039	ohms
Resistance of 1,200 lamps and leads	0.038	"
" field magnets of alternate current machine	0.44	"
Resistance of Gramme ring	0.165	"
" field magnets of dynamo	0.24	"
Number of revolutions	180	per min.
Difference of potential at terminals of alternate current machine	57.6	volts.
Difference of potential at terminals of exciter	36.4	"
Current in alternate current machine	1,516	ampères
" dynamo	88.8	"
Watts of alternate current	96,297	
" exciting current	6,663	
" in lamp circuit	87,330	
Electrical efficiency	85	per cent.

"The weight of the machine is about 15 tons. It was designed and constructed in the short space of three and a half months, and during the time of the exhibition was employed without any interruption to feed 900 Swan lamps of 20 candle-power each in the theatre, and about 300 others at the makers' stands." □.

Laying the New Cable.

Communications have already been exchanged over the first section of the new Commercial cable, between Rockport, Mass., and Dover Bay, Nova Scotia. The cable is in charge of representatives of Siemens Brothers, the manufacturers, at each end, and a continuous test will be made for a month, when the cable will be handed over to the Commercial Company.

Now that this operation has been performed, the Faraday will proceed direct to the position where the deep-sea section was buoyed, seventy miles to the eastward of the cable hut at Dover Bay. Picking up the end of the cable, the steamer will make the best of her way along a route already determined in the direction of Ireland, laying about one thousand miles—all she has on board. She will then buoy again and will proceed to Woolwich, where she will take in another cargo of wire. Her orders are then to go to Waterville, near Valentia, Ireland, land the shore end, and then start for the buoy last-named, where the final splice of the first ocean cable will be made. Communication will then be established between Ireland and the United States, and work can go on if the Commercial Cable Company resolves to begin operating with one transatlantic wire. When this has been successfully accomplished, the Faraday will go back to London and will take in the material for the second Atlantic cable.

How to Construct a Galvanometer.

BY THOMAS R. TALTAVALL—PART IV.

The next feature to receive our attention is the magnetic needle. As the interior dimensions of the box are only one inch long by one wide, the needle must be a little shorter than one inch in order to have ample room for free movement. Seven-eighths of an inch will be a convenient length. A quarter of a dollar will buy an ordinary pocket compass, the needle of which will answer our purpose. Seventy-five cents or a dollar, however, will get a needle with a jeweled bearing, which will make a more sensitive instrument. The advantage of using a needle with a jeweled bearing is that the friction is reduced to a minimum. The cheaper needle will answer for general purposes, but it will not respond so readily to feeble currents.

After having selected the needle, a pointer or index must be provided therefor. The material used by regular instrument makers for pointers is aluminum. This metal is peculiarly adapted to this purpose on account of its extreme lightness. Its specific gravity is only 2.6. It is so little used that it may be difficult to find on sale. If it can be obtained, however, it is far preferable to anything else. It is an expensive metal, but a piece two inches long by $\frac{1}{8}$ or $\frac{3}{16}$ wide, and as thin as possible, will suffice. It ought not cost more than 25 cents. It must be beaten out until it is quite thin. Aluminum is a very malleable and tenacious metal, and will admit of beating out to a great degree. We must not beat it too thin. The thickness of writing paper will be about right. When it has been beaten out to the required thickness it will have increased in length and width ; then we can cut out the pointer of the desired shape. The best and easiest way to beat the aluminum out is to lay it between two pieces of leather and hammer the leather over the metal, over a hard smooth surface—a flat iron for instance. Leave one end of the metal—about $\frac{3}{8}$ of an inch—unhammered. This is for the counterbalance.

If aluminum cannot be obtained, the next best material, probably, is a piece of thin, stiff card-board, such as a visiting card. The lighter the material the better, because we must avoid loading down the needle with unnecessary weight. That would increase the inertia. Inertia is that property of matter by which it tends, when at rest, to remain so, and when in motion to continue so; which is equivalent to saying that the heavier a body is, the greater will be the force required to move it. It is evident, therefore, that the heavier a needle and its pointer are, the greater will be the magnetic force required to move them.

A good shape for the pointer was shown in Fig. 8.

From the centre of the needle to the point of the index the distance must be a trifle less than that from the needle centre to the curved edge of the scale. The heavier part of the pointer extending back of the needle is the counterbalance. Its weight cannot be adjusted until we have united the pointer and needle, which is done in this manner : Drill a hole in the pointer at a distance a little less than two inches from its point. Next draw on a piece of paper two straight lines intersecting each other at right angles, then, after putting a drop of shellac varnish, or any other strong adhesive substance, around the edge of the hole in the pointer, place the latter on one of the lines with the centre of the hole exactly over the point of intersection of the lines. Then take the needle and place it on top of the pointer, with both its points on the cross line and its centre over the intersecting point. Hold the needle and pointer together firmly until the varnish has hardened. The joint, though firm, will not stand any hard knocks, but will be plenty strong enough for the delicate handling galvanometers generally get.

Now we must adjust the counterbalance. Our object is to adjust its weight so that it will equal the weight of the pointer. When this condition has been attained, the pointer will assume a horizontal position when the needle is suspended on a pivot. If the counterweight be too heavy, cut off enough to effect the balance ; if too light, it can be made heavier by wrapping tinfoil around it. The next thing now is to place the needle in its proper position at the centre of the box. Cut a piece of thin wood or stiff heavy cardboard, one inch long by one wide—the dimensions of the inside of the box—so it will slide in the box rather tightly. Locate the centre of the wood by drawing lines connecting the diagonal corners. The centre will be where these lines cross each other. Now we must supply a pivot for the magnetic needle. One-eighth of an inch of the point of a fine sewing needle, set firmly in the centre, will make the best kind of a pivot. Simply forcing it through the wood is all that is necessary to make it secure.

This use of a needle point may seem like a violation of the injunction already laid down against the use of steel or iron about the instrument. It may be regarded, however, as an exception to the rule. Nothing else would answer so well for a pivot. Moreover, the mass of steel in the point will be so small, and its position with regard to the magnetic needle is such that practically it will have no disturbing effect on the latter. A thumb-tack, such as used by draughtsmen to pin down the corners of drawing paper, may be made to answer the purpose of a pivot, provided it has a sufficiently sharp point and is of the proper length. When everything is in readiness hang the needle on the pivot and slide the wooden base into the box opening. The pointer, of course, must project from the front opening of the box over the scale. Figs. 8, 9 and 10, in Part III., show respectively the top, side and front views of the suspended needle and pointer, in its proper position. Depress the pointer a trifle below the level of the needle, as shown in Fig. 10, in order to bring it into closer proximity to the surface of the scale. This will enable us to read the deflections with greater accuracy.

We must now construct a suitable cover for the frame and scale, in order to protect the needle from air currents. A plain square box is all that is needed. It should be just large enough to cover the superstructure and no more.

In order that we may see the scale and read the deflections of the pointer, cut out of the top of the cover a semicircular piece about the size of the scale, and insert in its place a piece of glass.

Fasten the box to the base by means of brass screws from underneath. This will allow us to remove the box whenever necessary to gain access to the covered parts.

Mark on the base, between the proper binding posts, the resistance of the various coils, as shown in Figs. 8 and 11. Then, after providing the instrument with four feet to stand on, it will be completed. Brass nails with conical heads can be bought at any hardware store and will answer the purpose very well. Drive them in evenly, so the instrument will stand on them all.

Now our instrument is finished and ready for use, a brief consideration of the laws of electricity and magnetism so far as they apply to galvanometers will be in order at this point. This information is designed more especially for the benefit of beginners, who do not understand why a galvanometer needle is sometimes deflected but very little and at others a great deal ; and why it sometimes turns one way and sometimes the other.

(TO BE CONTINUED.)

Women as Telephonists in England.

A week or two ago, the London *Pall Mall Gazette* published an account of the employment of women as telephonists in England. The results of its inquiries upon the subject are given as follows: Three years ago the United Telephone Company began to employ women. "Chiefly for reasons of economy," we learn, but besides this there are other advantages. If a boy 14 years old is employed as a telephonist his voice will before long become hoarse and indistinct; with a girl this is not the case. The female voice is always clearer, and as a clear voice (besides a good ear) is one of the chief requirements of a telephonist, women are naturally preferred. They are admitted at the age of 16, the majority of those at present employed by the United Telephone Company being between the ages of 16 and 22. From the number of two with whom the experiment was begun, they have risen to over a hundred, who perform their duties to the satisfaction of the company. Preference is given to the daughters of professional men; this, however, is no strict rule. There are no preliminary examinations to be passed before admittance into the telephone office. The different ranks are the clerk in charge, who has the supervision of a room, in which are employed from six to fifteen clerks; the deputy of the clerk in charge, the first and second class operators, and the learner. According to these ranks the payment varies: as a rule, however, 11s to 16s. is the weekly pay, which sometimes rises to £1, and in rare cases to 25s. The hours of work are from 9 till 6 or 10 to 7 respectively. No case of illness has occurred on the staff since the commencement of the work; the general state of health is also satisfactory, and the lady superintendent of the whole staff is of opinion that the girls are on an average well satisfied with their situation and fond of the work. It is perhaps a disadvantage that telephonists have to talk all day long; but this very fact is said to prevent them from indulging in disputes and gossip and makes their work comparatively quiet—a point upon which some subscribers to the exchange have been known to entertain a different opinion. The rate of pay mentioned is very low.

An Electric Laryngoscope.

In Philadelphia, last week, Dr. Carl Seller, of that city, presented and described his electric laryngoscope, for illuminating the cavities of the body. He described other and earlier apparatuses for the same purpose, some of which failed to give out sufficient light. After completing his experiments with the arc light he tried a small incandescent lamp, which broke, delaying his work till others were obtainable, when he completed his invaluable invention, which consists of an ordinary head mirror, which has attached to its lower rim a bar about four inches long. An incandescent lamp of six-candle power is mounted on the end of the bar, and between it and the reflector is a simple bi-convex lens of short focus, to converge the rays of light on the reflector. On the side of the lamp, away from the reflector, is a shield of silvered mica to protect the patient's face from direct light. The conducting wires run from the lamp to the head-band, to which the reflector is joined by a ball and socket joint, and thence to the battery. Thus the examiner is not dependent on any stationary light; when the mirror is adjusted light is always thrown in the direction of the axes of the eyes.

Electric Lamps and Regulators.*

BY DR. N. S. KEITH.

(*Concluded from page* 91.)

There have been endeavors, other than by Hochhausen, to avoid the use of either of the differential systems of regulating the length of arc. It seems to the investigator that, in reality, the electromagnetic coils in the main circuit of any lamp in a single series take no part in effecting the feed movement. They only act to establish the arc, and after that is formed the current in the main circuit, and, consequently, the magnetism of the electro-magnets therein, remain practically constant. Therefore the feed movements are due to the difference between the constant dynamic value of a constant current exerted upon the constant resistance of the main-circuit magnet, and the inconstant dynamic value of an inconstant current exerted upon a constant resistance. In so far, the weight *A* of the Hochhausen lamp, Fig. 28, is the equivalent of the electromagnetic solenoid *R* of the Hefner-Alteneck lamp, Fig. 23.

But if, for any reason, the carbon-carrying rod *I* of the Hochhausen lamp should slip downward until the carbons come in contact, the arc cannot be re-established automatically, because the spring *E* will not continue to lift the lever *F* and its attachments to separate the carbons. Under such condition it becomes necessary to shunt the current around the lamp for an instant, and then the weight, or core, *A*, drops onto the lever, and then when current is again passed through the lamp it is lifted and the arc formed as I have described.

In the Brush and Hefner-Alteneck types of differential lamps, this just-described condition does not exist. In the Brush lamp, for instance, when the carbons are together, very little current flows through the high resistance coil, and therefore the coil's dynamic value is small, and it detracts but a correspondingly small part from the dynamic

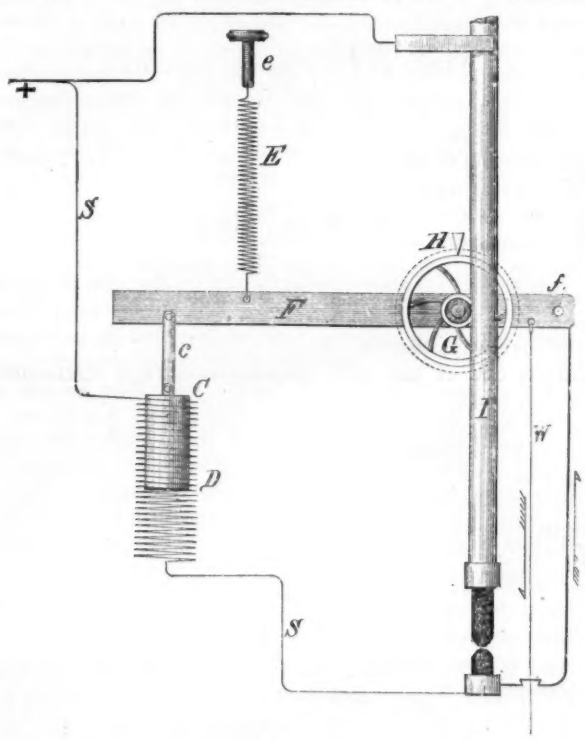

FIG. 29.

value of the low resistance, or main-circuit coil, leaving the latter free to lift the carbon-carrying rod. To be sure, the mechanism of both lamps may be defective, so that slipping-by of the rod takes place, but of the two the Brush is sure to recover its arc if the clamp can have any grip at all. Oftentimes the carbon-carrying rods of both the Brush and Weston lamps slip through the clamps till the carbons come together, but a short arc is immediately produced by the lifting of the clamp by the power of the main current magnet coils.

I have devised a lamp, the principle of which is illustrated by Fig. 29. The arc is formed by thermic expansion; and the feed movements are regulated by a solenoid in a circuit derived around the arc and of comparatively high resistance, as in the previously described lamps.

I represents the positive carbon-carrying rod, which has a rack which engages with a pinion on the arbor of the cog-wheel *G*. This cog-wheel represents a train of wheels which ends with a pendulum escapement to regulate the speed of feed. This train is carried in a frame lever *F*, which is pivoted at *f*, lifted by the spring *E*, and pulled downward by the core *C* within the solenoid *D*. *H* is a fixed stop, or detent, which engages with one of the wheels of the train, preferably with the last one, whenever the spring *E* preponderates over the solenoid *D*. But when the reverse is the case, *F* is pulled downward until the train is freed from the detent *H*, and the wheels move by reason of the gravity of the carbon-carrying rod.

The current enters the lamp at the positive binding post, through the coarse wire and flat spring enters the rod *I*, passes through the two carbons and takes the course upward, as shown by the arrow, to the train lever *F*, which is insulated from all other parts of the lamp except the wire *W*. The current flows down this wire to the negative binding post of the lamp. At the positive binding post a small part of the current takes the course through *S*, *D* and *S* around the arc.

The wire *W* is made taut at normal temperatures, so as to pull *F* downward against the tension of the spring *E* and out of engagement of cog-wheels with detent. The wire *W* is also of such size that a normal current will heat it sufficiently to cause it to expand so that the spring *E* may raise the lever *F* and the rod *I* to form the arc, and the cog-wheel into engagement with the detent. Thereafter the movement of the lever to allow of the feed is effected by the action of the solenoid *D* on the core *C*, as in the Hochhausen lamp.

The wire *W* is so placed in relation to the other parts of the lamp that as soon as it has expanded it is automatically short-circuited so that, by reason of the thus lessened current in it, it contracts, to be ready to expand whenever it becomes necessary to do so to re-establish the arc, whether from stoppage or over-feeding.

A recent modification of the *Lampe Soleil*, or Sun Lamp, to which I referred in describing Fig. 17, is shown in principle by Fig. 30. *A* is a tubular section of marble or other refractory, non-conducting material. *B* is a solid carbon

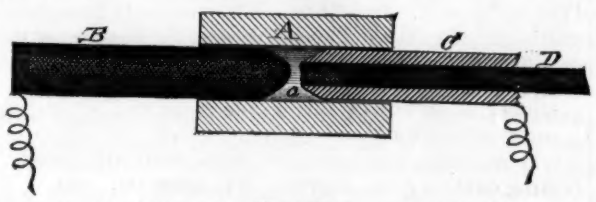

FIG. 30.

rod, and *C* is a carbon tube, in which is free to move a carbon rod *D*. By means of suitable shoulders within the tube *A*, the large carbons are prevented from touching each other. When no current is flowing the small carbon rod *D* is in contact with the large carbon rod *B*. But it is attached to a core of a solenoid which, when current is started, draws *D* away from *B*, and thus establishes an arc at *a* within *A*, and between *B* and *C*. By the heat of this arc the temperature of *A* is raised to the point of giving light. This light is much commended for its softness and steadiness, but its economy is seriously questioned. The current used is an alternating one of comparatively high electromotive force—enough to sustain an arc within he marble tube of exceeding half an inch; though some of this length may be ascribed to the conductivity of the vapors in the arc.

I might spend many evenings in describing the various constructions and arrangements of mechanisms which have been made for the improvement and toward the perfection of arc-lighting, but I must even now defer till some fitting opportunity much which I expected to speak of tonight, for I see that it is now getting so late that I will not take up the subject of "lighting by incandescence," so called, nor can I now consider semi-incandescence. I have considered, necessarily briefly, the rise of the art, and all of the prominent distinctive systems of regulating arc lamps, and must end this, to me, interesting subject by referring very briefly to the double lamps, and then to those specimens of lamps which have been kindly loaned to me, for exhibition at this lecture, by the Fuller, Gramme, Excelsior and United States Companies.

At present, for various reasons, it has been found most practical to make the carbon rods twelve inches in length. The positive carbon lasts, on the average, eight hours, and the negative carbon twice as long. Therefore a change of the positive carbon must be made some time during the duration of our long winter nights. This change is effected

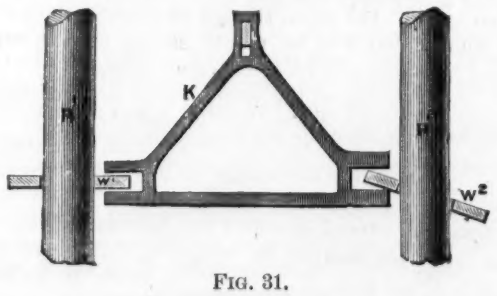

FIG. 31.

automatically, by means of a lamp which carries two sets of carbons, one set only being in circuit at once.

Fig. 31 represents the means employed in a Brush double lamp to effect this automatic change. *K* is a yoke attached to the magnet core through the lever, the end, *L*, of which is shown. This yoke is so made that it lifts one of the clamps W^1 and W^2, which engages the carbon-carrying rods P^1 and P^2, before it does the other. Both rods are in circuit in "parallel" before current is started through the lamp. When one is lifted the current ceases to flow through it, because its circuit is broken, though it continues through the other. Immediately thereafter the second is lifted, and the arc is formed at its point, as in other cases of single lamps.

The first lifted is held by its clamp until the other is burned out and cannot move down any further. Then the arc gets so long that the current diverted through the high-resistance coils causes the core to move so far downward that the clamp first lifted comes to rest on its stop, or trip, and allows its rod to slip in feed movement. This brings this pair of carbons in contact, so that the current shifts to them, because that path is so much less in resistance than the former. The main-circuit coils then assert their force to establish an arc at this pair.

Fig. 32 represents the method practiced by Hochhausen and others. *A* and *B* are the two carbon-carrying rods. *A* has on its side near its lower end a pin *a*, which engages with the L lever pivoted at *P*, when the rod is at about its topmost position and with a full-length carbon in its clamp. The pair of carbons belonging to this rod are not placed in contact, but say ¼ inch apart. The rod *B* has a pin *b* on its side, at a point where, when the rod is at nearly its lowest position, the pin engages the end d^1 of the L lever. When the carbon belonging to rod *B* has burned nearly out, the pin *b* rests on the lever and forces the end *e* on from under the pin *a*, so that the rod *A* moves downward until its carbons come in contact; when the current takes that path, the arc is established and the feed goes on.

After thanking you for your kind and patient attention, as I now do, I conclude by inviting your attention to the artistic design of some of the lamps on the stage and to the ugliness of others. It would seem well that the manufacturer should make his work reasonably pleasing to the eye, where he can without sacrifice of utility.

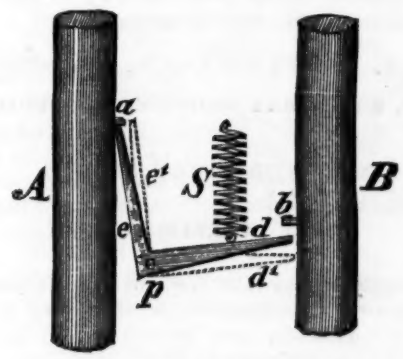

FIG. 32.

* Lecture delivered before the New York Electrical Society, Jan. 16, 1884.

The Electromotive Force of Accumulators.

M. Reynier, the well-known electrician, has, according to *Engineering*, made experiments on three systems of secondary battery: (1) the Planté accumulator of reduced lead, peroxide of lead, and sulphuric acidulated water; (2) the copper accumulator of lead, copper, lead peroxide, acidullated solution of sulphate of copper; (3) the amalgamated zinc accumulator of zinced lead, lead peroxide, acidulated solution. His object was to test the electromotive forces of the combinations and find their variations of sulphate of zinc. The accumulators were not completely formed. The electromotive forces were measured during charge and discharge by the method of equal deflection. His results confirm those formerly obtained by M. Gaston Planté, and are as follows: (1) In the three systems of accumulators studied, the secondary electromotive force is notably more elevated during charge than during discharge. The ratio of the smallest of these values to the greatest may be called the *co-effieient of fall*. It is a factor of loss which affects the efficiency of accumulators. (2) The fugitive super-elevation of the electromotive force augments with the intensity of the charging current and the electromotive force of the source. (3) In the Planté accumulator the electromotive force is at least 1.95 volts during the charging and at most 1.85 volts during the discharge. The co-efficient of fall is therefore 0.95 under the most favorable conditions. (4) In the copper accumulator the electromotive force is at least 1.43 volts during charging and at most 1.25 volts during discharge. The co-efficient of fall is therefore 0.87 under the most favorable conditions. The copper accumulator is that which loses most. (5) In the amalgamated zinc accumulator the electromotive force is at least 2.4 volts during charging and at most 2.36 volts during discharge. The co-efficient of fall is 0.983 in the most favorable conditions. The amalgamated zinc accumulator is that which loses least. (6) In practice the losses due to variations of electromotive force will be greater than are indicated above, because the times of charging and discharging are generally more rapid than correspond to these experiments.

STORAGE BATTERY STOCK.—The partner of Jesse Grant, a younger son of the General, in the brokerage business at No. 2 Wall street, is Stephen F. Moriarty, who has interested himself specially in the practical use of electric storage batteries. In April, 1883, he borrowed from George William Ballou the sum of $5000, for which he gave his note, and as collateral security shares of the Electric Accumulator Company. The note not having been paid at maturity, Ballou sold the stock at auction, and bought it in himself at $300, which sum he credited Moriarty with on the note. Subsequently he transferred the note to Henry H. Remington, who sued Moriarty on it. As a defense Moriarty alleged that Ballou had endeavored to exact usury by insisting that, in addition to the $5000 and interest, he should receive a bonus of 100 shares of the Electric Accumulator Company stock. He also asserted that the sale of the collateral stock was not made in good faith by Ballou, but he did not back up his answer, and Remington took judgment against him by default in the Court of Common Pleas. Mr. Remington has since obtained an order for Moriarty's examination in supplementary proceedings, and the examination began on May 22.

THE
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W. J. JOHNSTON, - Editor and Publisher.

ASSOCIATE EDITORS.

C. O. MAILLOUX, N. S. KEITH, - - - Scientific Department.

T. C. MARTIN, - - - - - News Department.

CLARENCE E. STUMP, Business Manager.

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NEW YORK, MAY 31, 1884.

GREEK MEETING GREEK.

The struggle between the Western Union Company and the Baltimore & Ohio Company is of a very interesting and lively character, and by the time it ceases, both parties will have had enough of litigation. No sooner is the question settled in one part of the field than war breaks out again in another, and so with varying fortune the fight goes on.

We have chronicled the events and developments of this hot struggle from time to time and cannot see yet any indication of truce or peace. Last March the Garrett people by strategy and force of arms, gained possession of a Western Union branch office in Philadelphia, and soon after that the attempt of the Western Union Company to prevent the Baltimore & Ohio Company from taking possession of the National Telegraph Company's lines failed. Then the Baltimore & Ohio Company sought to gain a foothold in New England, but having presented a petition to the U. S. Circuit Court at Hartford, Conn., for an order directing the New York & New England Railroad Company to afford certain transportation facilities to them in the construction of their new lines, the Court held that it was not warranted in disturbing the contract between the Western Union and the railroad companies, under which the former was to enjoy exclusive privileges. About two weeks ago the Railroad Commissioners of Massachusetts also dismissed the petition of the Baltimore & Ohio Company for special facilities in that State over the same road, as they held the aforesaid contract to be legitimately exclusive. Thus the Western Union scored a few points.

But the turn of Mr. Garrett and his associates has come around again. On May 25, Chief-Justice Waite filed a decision at Baltimore in the long-pending case between the two companies as to the ownership of the lines on the main stem of the Baltimore & Ohio Railroad. It will be remembered that in his evidence at Washington this winter before a committee, Dr. Green claimed those lines for his company. The Western Union Company, as successors to the old Western Telegraph Company, contended that the lines reverted to them under the contract by which they were erected by the railroad authorities in 1855, from Baltimore to Wheeling and Parkersburg. To this the Baltimore & Ohio Company replied that the contract had expired, that the Western Union had no rights now under it, and that possession and operation of the lines had been solely enjoyed by themselves since 1877. The Court upholds the position taken by the defendants, giving to the Western Union Company simply the value of one wire, which was tendered to them by the Baltimore & Ohio Company on taking possession in 1877.

One would think that the rivals had had all they wanted of law, but it appears that further embittered litigation has now been entered upon by them, each enjoining the other from increasing plant in certain portions of this city. At least three other suits are also pending between them, and probably more will soon be announced. But the fight will not be limited to the courts. We may expect to hear of the briskest kind of competition during the sittings of the political conventions at Chicago, and it is even possible that the contest will be prolonged on a basis of lower rates.

THE TELEPHONE IN GERMANY.

We do not think that the advocates of governmental systems of telegraphy and telephony can derive much comfort from the figures published as to the progress of the telephone, commercially, in England and Germany. We rarely take up an English electrical contemporary without finding in it some kind of protest against the manner in which the government officials mismanage and muddle the telephone service, hampering the licensed companies and preventing the public from anything like general use of the instrument. One little incident recently brought to light is amusing, but it does not present the conduct of the post-office authorities very favorably. It appears that a demand was made by them on one of the telephone companies of royalty of one-tenth of the money received by it for the insertion of advertisements in its own directory, printed at its own expense and intended for the use of its subscribers! It is now explained that the demand was made "in error." Between official red-tape and the stupidity of local boards, the English telephone companies are evidently enjoying "a good time."

A very interesting table of German telephone statistics has appeared in the London *Postal, Telegraphic and Telephonic Gazette*, showing what has been done in the German Empire by the post-office, in whose hands is vested the sole control of the telephone. It is difficult to believe that the figures are so small, although the tabular statement is official and it is complacently said that the progress made has been considerable. At the end of 1883, there were 5,851 telephones connected—or 6,182 if we include those fixed in telegraph stations for the telephonic dispatch of messages received there—or, in all, only about as many in the whole of the Fatherland as there are in the two cities of New York and Boston. Out of the 5,851, Berlin has 1,625 and Hamburg 1,026. The total number of connections, again, is absurdly insignificant. In December, 1883, they were 905,286, or, taking the year round at the same rate, 10,863,432, as compared with 215,280,000 per annum in the United States, where there are also about two million toll line connections annually.

These figures tell their own tale. The *Gazette* says: "It will be seen that the rate of progress in Germany is at present greater than in this country, the restrictions lately introduced by the English post-office with telephone licenses preventing the erection of new exchanges. . . . It must be a matter of great regret to all interested in rapid intercommunication that the English post-office persists in following so illiberal a policy." We should think so, but it was ever thus with governmental intermeddling in commercial enterprises.

THE PROPOSED ELECTRICAL CONFERENCE.

In the interim between the customary electioneering schemes now prevalent, Congress might, as we have already urged, do a good stroke of work by paying some attention to the advancement of science, especially in the electrical world. The bill authorizing the President to call a national conference of electricians to meet in Philadelphia next fall, has been reported favorably by the Committee on Commerce and referred again to the House Committee on Appropriations. The sum asked for is but $25,000, while the work proposed bears upon one of the most important industries of the day, and we see no reason why the bill should not be passed at once. Private enterprise is pushing the electrical exhibition forward to completion, and it is only proper that, after the Government has given the project an international character, Congress should act at once upon the trifling appropriation.

PLAY AGAINST LOADED DICE.

At a time when one of the chief indictments of gas-makers and vendors against the electric lighting companies is that the candle-power of the electric light supplied is overstated for purposes of deception, it is rather significant that in New York at least there is general complaint that the bills sent in for gas have been more exorbitant during the last six months than ever before, and that they are steadily on the increase. Several letters have appeared in the papers giving instances of high charges for gas not consumed. One gentleman, for example, furnishes striking figures of "extortion that is disgraceful, if not criminal," and after telling how by economy he tried in vain to cut his bills down, he says: "I was playing against loaded dice." Another gentleman, who gives his name, too, tells a similar story of increase in his bills, and remarks: "There was no improvement in the quality of the light and no increase in the number of burners. I made use of every method known to me for saving the consumption of gas. New burners were frequently put on and gas-regulators were used, and the most rigid economy was practiced throughout my house, but my efforts were fruitless." It is not to be wondered at, then, that the consumers are making common cause against the heavy bills, or that it is proposed to get rid of the companies by buying them out.

To put the gas-works in the hands of the local politicians would be to jump from the frying-pan into the fire, and there is not much likelihood that the transfer will be made. But the present discontent of the public with the gas companies is advantageous to the electric light, and we trust that the opportunity will be availed of in the proper way,

A MORSE CODE OF SEA SIGNALS.

When the steamship "City of Rome" passed the bark "Ponema" recently she did not stop to succor the shipwrecked crew and passengers on board of the latter vessel, because, as the officers of the "City of Rome" allege, they could not read the "Ponema's" flag signals. There was no wind and the flags doubled under so that the "City of Rome" could read only "State of ——." A Morse operator and a steam whistle could easily have telegraphed "State of Florida," and have obtained besides a full account of the wreck. There is no good reason in the world why the Morse code of signals should not be used on steam whistles at sea—for ships, light-houses and whistling buoys—in place of the antediluvian flag system, which, it would appear, no one can read. Ships run ashore sometimes because their captains mistake one light-house, which shows a flash-light, for another, which also shows a flash-light. As long as their lights are "flashing" at night, Sandy Hook might as well emit three successive flashes, thus continually making a Morse "S," while the Delaware Breakwater, by flashing a Morse "B," would act as an unmistakeable guide to the intelligent mariner. A steam whistle operated by Morse signals, could be used day or night, rain or shine, fog or snow-storm, each vessel carrying an operator as purser, or in some other fitting capacity; and the line which shall first adopt this system will find therein an advertisement greater than a six-day Atlantic passage. The tourist now buys three thousand miles of danger for $100, and we believe he can get less for less money.

THE NEW CABLE.

It is matter for general congratulation that the first part of the new Atlantic cable has been laid successfully. This cable and its companion will be the first distinctively American cables, and that fact alone would warrant some degree of public interest in them. But they are also a pledge that there will be as much healthy competition in ocean telegraphy for the people of this country as exists already on land, and that rates will be reduced to a point as low as actual cost, reasonable working expenses, and a fair profit will allow. As long as competition of this description goes on, there will be no need of government telegraphs on sea or land, and little clamor for them.

A Trip to Europe.

Mr. W. J. Johnston, the editor and publisher of THE ELECTRICAL WORLD and *The Operator* left for Europe on May 29, by the steamer "State of Georgia." He was accompanied by his family. The members of the staff of the two papers assembled on board to see their chief and his friends off, and to wish them a safe voyage and a pleasant sojourn abroad. Mr. Johnston takes his vacation in Europe in order to secure a release from the pressure of business, to an extent that would hardly be possible if he merely remained within reach of hourly telegrams and the daily mail. It is expected that he will return about the end of August.

EXTENSION OF TIME.—The U. S. Senate passed a bill on May 20 extending to August, 1886, the time to commence laying the cable authorized by act of August 8, 1882. The parties interested in the bill are mainly citizens of New York and Philadelphia. This will be the first cable constructed under the law of Congress and amenable to the law, none of the existing ocean cables being under the control or direction of the law. The new company expects to send eight or ten messages simultaneously over the same wire.

SUIT FOR OMISSION.—The following case was decided in the Des Moines U. S Circuit Court, May 23: On Nov. 9, 1882, George F. Hall, at Des Moines, at 8 A. M., gave the following message to the telegraph company: "Charles T. Hall, Exchange, Oil City, Penn.—Buy 10,000 if you think it safe. Wire me." He meant for his broker to buy 10,000 barrels of petroleum for him. The company omitted to send the address, "Charles T. Hall," and the message was received at Oil City directed simply to "Exchange," which is the name of the building where the Board of Trade met. The company, on refusal of the officers of the Board of Trade to receive it, procured the correct address and delivered the message to Charles T. Hall at 6 P. M., too late to make the purchase directed. The price of oil at the time the message ought to have been received, at 11:30 A. M., and when the oil would have been purchased if received, was $1.17 per barrel. The price at the opening of the market the next day at 10 A. M., was $1.35. The plaintiff gets judgment for the difference on the 10,000 barrels, being $1,800, and the Court certifies a division of opinion on certain legal questions to the Supreme Court of the State, in case of the defendant's desire to carry the case there.

Electric Light Portraiture.*

BY G. H. SHERMAN, ELGIN, ILL.

The subject before us to-night might well have been assigned to better hands, but I will do as well as I can to entertain you, and give you my method of using the electric light in photographic portraiture. I have had electric light on the brain, as it were, for a year or more, and having seen it established as a general illuminator in our little city of Elgin I thought I would try it on negative making. I had talked with several who had used the light to some extent, and all thought it would do, but it was quite expensive, some parties having expended several thousand dollars in the experiment.

After witnessing the demonstration at Milwaukee last August, and having seen some of the work from other sources, I felt a little discouraged, but still I was bound to see what I could do with one light. I got no expensive plant—merely one light from a circuit of thirty lamps used in our stores. The lamp is of 2,000 candle power, of the Van Depoele system, for which I pay $12.50 per month. So you see that I hazarded very little in the trial. I have as yet attempted nothing but bust and half form, as my arrangement of the light is more adapted to these styles.

I will now give you a description of my mode of operating. We will begin with the light, which, as I said before, is one of the Van Depoele lamps suspended near the centre of my reception room. It is arranged with cord and pulley, so as to be raised and lowered to any elevation. I use a large ground-glass globe. I wish to say in this connection that, as far as my experience and observation goes, I think the Van Depoele light is the best for photographic uses. We next have a circular concave reflecting screen of fine white muslin. This is also fixed to a standard, and made adjustable to any height and angle. This I place within a foot of my lamp. I also have a mirror about 16×24 made adjustable. Next are my screens, etc. On the side next my lamp I have a screen of white muslin, 7×8 feet. In the centre and near the top is an open space, 2×3 feet, which I fill with one or two thicknesses of blue gauze. This softens and diffuses the light. In the centre of this gauze I place an oval piece of white tissue paper, sometimes two thicknesses, which I arrange so as to come directly between the sitter and the bright spark of the lamp. This also has a tendency to soften and diffuse the light. From the top of this side screen I have a projecting screen of the same material coming out over the sitter, adjustable to any angle. This, when used properly, serves to give the combined top and side light effect. Next I have a large screen, or reflector, which I place on the opposite side of the sitter. This is also adjustable. I also have a hand screen or white muslin reflector which I use to throw the light in any direction and soften shadows. I use the ordinary background, or sometimes unbleached muslin. I light the whole or any part of the sitter or background with my mirror reflector.

This is my simple *modus operandi*, and if it will do anybody any good they are welcome. I make no issue with Vander Weyde, Kurtz, or any of the "high lights" in photography. I do not say that my way is best, or that it cannot be improved upon; but I do say that it is simple, cheap, and with me, successful. I have received numerous letters from parties asking information, etc., all of which I have answered as best as I could. I will say to any and all, get a lamp and try for yourselves.

Have used the light for printing with good results; also in copying.

HINTS.

If you use the electric light, *don't take tin-types.*

Give full exposure, time about the same as with wet plate.

Use the most rapid dry plates.

*A paper read before the Chicago Photographic Association, May 7 884.

Birds Caught and Killed by the Light.

A dispatch of May 24, from Winona, Minn., describes a very curious incident in connection with the use of the electric light there. It says: Every night this week thousands of migratory birds have gathered about the electric light on the stand pipe in this city. Between the hours of 1 and 2 o'clock the birds were seen in swarms about the light, and hundreds fell to the ground. A few were caught alive, but the larger part were dead. Prof. Holzinger, of the normal school, reports the following species among those collected during the past two nights at the water works: Catbirds, grossbeaks in variety, scarlet ranagers, golden crown thrushes, water thrushes, chestnut-sided warblers, blackburnian warblers, Tennessee warblers, magnolia warblers, Carolina rails, yellow-throated vireos, black and white creepers, traels, fly-catchers, green-crested fly-catchers, Savannah sparrows, white-throated sparrows, Maryland yellow-throats, black-billed cuckoos, helldivers, indigo birds and yellow-bellied woodpeckers. On Tuesday night the grossbeaks predominated, and on Wednesday night the rails. Catbirds were numerous on both nights. The birds which breed in this locality were noticeably absent. Valuable additions from these birds are being made to the museum of the Society of Arts and Science, and a set of duplicates of most of the varieties has been furnished by Prof. Holzinger to the high school collection. Many of the birds which were caught alive may be seen in cages at the engine house of the water works.

The Colburn Dynamos.

Messrs. I. W. Colburn & Co., of Fitchburg, Mass., have been manufacturing for some years various sizes and styles of dynamo-electric machines, to fill the various requirements of those who desire reliable sources of electricity for use in electric lighting, electroplating, electrotyping, laboratory experiments, surgical and medical purposes, etc., etc. The sizes vary from machines run by hand-power to those requiring five horse-power, and there are five or six different styles made in various sizes to suit the requirements and tastes of purchasers.

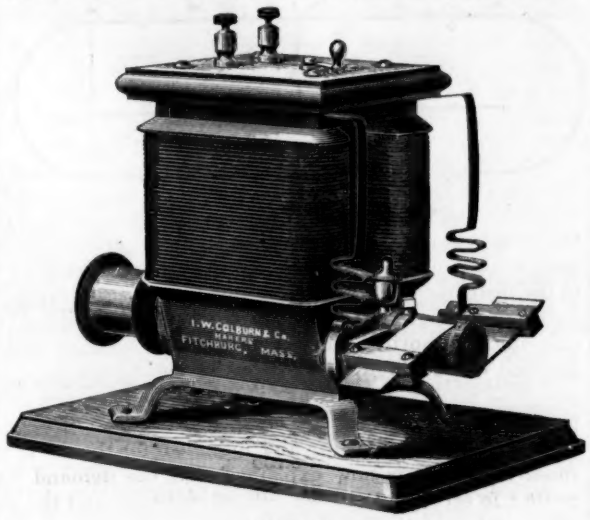


FIG. 2.

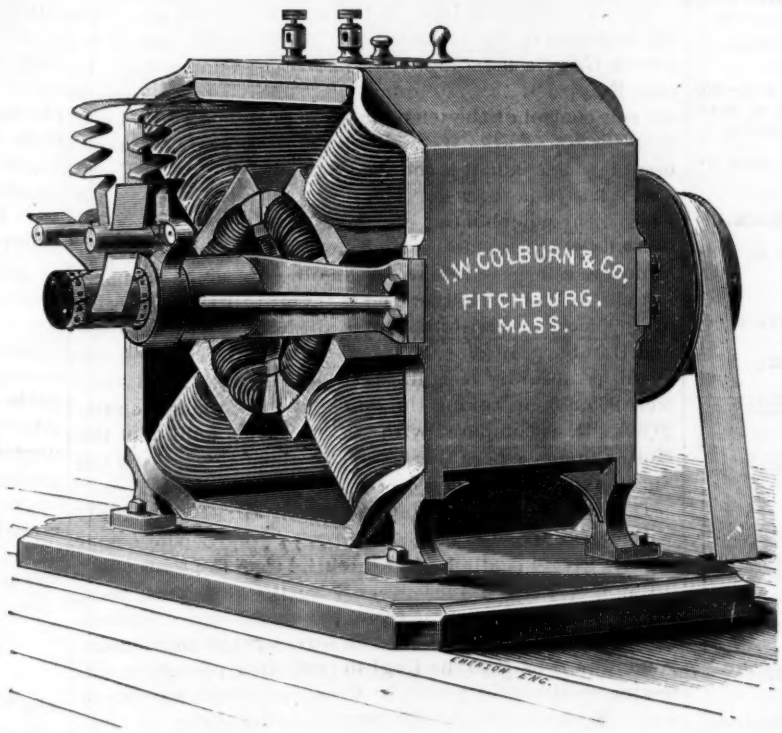


FIG. 1.

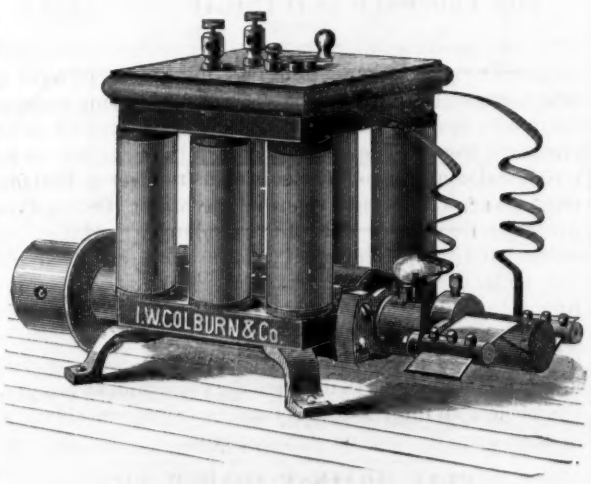


FIG. 3.

These features are novel in the trade; the various companies in the business as a rule manufacture and sell only those dynamos which are used in their special systems of lighting.

We print herewith illustrations of three styles which are made by this concern. Fig. 1 represents the electric-light machine. The field-magnet poles are four in number and are of north and south polarity in succession on the line of rotation of the armature. The armature is a modified Pacinnoti one, but with only four polar projections. There are eight bobbins and the same number of sections to the collector. The two brushes are placed 90 degrees apart. The form of field-magnet is one which tends to concentrate its magnetism on the armature, and at the same time is compact and strong, with no liability to be sprung out of line when screwed to the base. This style of machine is also made for electrotyping and electroplating.

Fig. 2 is a machine of the Siemens-Wheatstone type. The cores of the field electro-magnet are made of cast iron, and the winding is of low resistance for the purpose of producing currents for electroplating purposes. The machine is strongly and tastefully made.

Fig. 3 is another plating machine. Its cores are made of wrought iron, which insures greater capacity for a given weight. The armature is of the Siemens H type; and the parts are so proportioned that from the smallest to the largest current within the capacity of the machine may be generated.

This house also makes a hand-power with one or two cranks, and on its base one of either of the smaller machines may be placed. This is a very convenient apparatus for small work.

Development of a Great Business.

Some very interesting particulars are given in the Chicago *Times*, of May 17, of the growth of the Western Electric Company, of whose grand new building it gives an illustration as accompaniment to a full page description. The article says: Some time previous to 1870, Enos M. Barton, the present vice-president and general manager of the Western Electric Company, and Prof. Elisha Gray, of telephone and multiplex telegraph fame, started a small telegraph shop in the city of Cleveland. Appreciating, however, the superior advantages offered for doing a wholesale and manufacturing business by a metropolitan city like Chicago, they removed to the latter city in the year 1870, first locating their shop on La Salle street, but moving very shortly after to No. 479 State street. In 1872 the Western Electric Manufacturing Company was organized under the presidency of Gen. Anson Stager by the consolidation of the business of Gray & Barton and that of the Ottawa shop of the Western Union Telegraph Company. By strictly keeping up the high standard of excellence in the quality of the instruments produced, and by carefully extending the business, the Western Electric Manufacturing Company prospered. The volume of business handled by the company immediatly after the consolidation warranted the securing of larger quarters, and in the summer of the same year the company moved into the building which had been erected for it on East Kinzie street, Nos. 220 232. In 1875 the business of George H. Bliss & Co., who had succeeded to the business of Bliss, Tillotson & Co., was taken over by the Western Electric Manufacturing Company. About the same time it took the business of the Electrical Improvement Company of Galesburg, Ill. In 1878 the Western Electric company took the shop and business of the Western Union factory of New York, and has since then conducted that business in New York. Having thus two bases of supply, they were able to take full advantage of the development of the telephone business, with which they have been most closely identified from its inception.

In 1882 the business of the Chicago Telegraph Supply Company was taken over. In 1882 the business of the Gilliland Electrical Manufacturing Company of Indianapolis, and that of Charles Williams, Jr., of Boston, were taken over, and the name of the company changed to Western Electric Company.

The company was now operating the three largest telegraph and telephone shops in America, and the demands of customers were taxing the producing capacity of these factories to their utmost.

Steam Engine Tests at the Electrical Exhibition.

The Franklin Institute has tests proposed for steam engines at the International Electrical Exhibition. The conditions of exhibition and test are very ample and, on the whole, likely to give satisfaction. Exhibitors desiring quantitative tests made of their engines must send in formal application before July 15. Competitive tests will not be made, save on the joint application of two or more parties desiring them, and the competing manufacturers must, previous to the tests, agree on the rating of the various points of the engine, subscribing to the code and agreeing to abide by the decision of the judges without appeal. The code is in two sections: conditions of exhibition and test; and preparations for the tests.

INDIANAPOLIS, IND.—The May Directory of the Indianapolis Exchange, Mr. L. G. Hough, manager, operated by the Central Union Telephone Company. The subscribers are evidently increasing greatly in number. We notice a list of over 100 residences, now connected with the Exchange.

RIO DE JANERIO.—Judging by the bulky directory of 120 pages that has reached us, the Rio Exchange is in a most flourishing condition. Mr. W. I. Donshea is the general superintendent, and keeps the service in excellent condition.

A Galvanometer and Battery Test.

BY E. RAYMOND BARKER, MADEIRA.

The comparison of Electro-Static capacities by DeSauty's W. B. method is effected as follows:

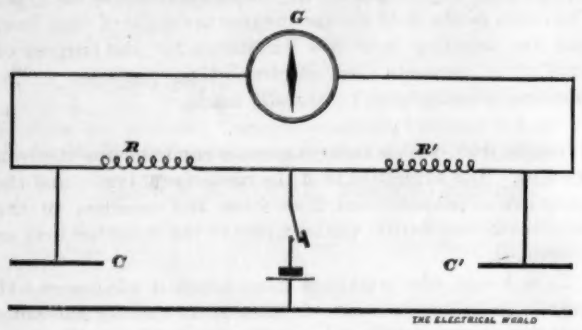


FIG. 1.

Where R and R' are known and adjustable resistances, C a known and adjustable capacity, and C' an unknown capacity. Then

$$R : R' :: C' : C \text{ and } C' = C\frac{R}{R'}$$

This test may be reversed, and, by means of two known capacities and a known resistance, the value of an unknown resistance may be arrived at. Then if C, C', and R be known and R' unknown, once a balance has been obtained, one has $R' = R\frac{C}{C'}$

By developing the above facts, a convenient method is arrived at for ascertaining the resistance of either battery or galvanometer. These two tests, it will be seen, bear a certain analogy to Mance's W. B. battery test and to Thomson's W. B. galvanometer test.

Galvanometer Test.

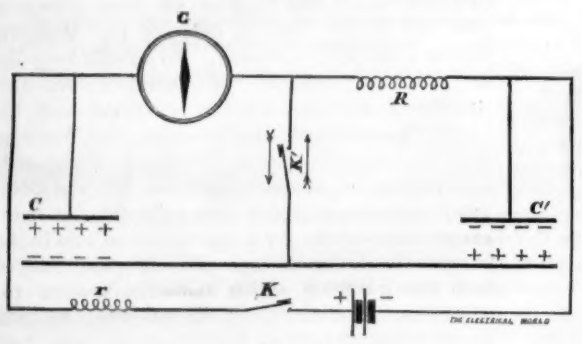


FIG. 2.

G = Galvanometer of resistance *unknown*.
R = Resistance known and adjustable.
r = Convenient resistance inserted in battery circuit without influencing conditions of test.
C and C'. Two condensers, or one divided condenser of known and adjustable capacity.

Any one or all of the three values R, C and C' may be made adjustable.

Then the unknown resistance of G may be arrived at as follows:

Battery with instruments having been connected up, as shown in Fig. 2, K is depressed, a certain deflection d being thus obtained on G. R, C and C' are now adjusted until d remains undisturbed on the closing of K'. When this is the case, $G : R :: C' : C$ and $G = R\frac{C'}{C}$

In practice it is convenient to make C and C' equal, and to adjust R until a balance be obtained; then

$$G = R.$$

It will be found that if the balance be *out* one way or the other—if, for instance, R be higher than G, the closing of K' following upon the depression of K with its accompanying deflection d will cause a "*throw*," say to the right of the already deflected "spot." If, on the other hand, R be lower than G, the "*throw*" will be to the left of d, the "*spot*" in both cases immediately returning to position d. But when $R = G$, assuming that $C = C'$, a balance is arrived at, and the closing of K' in no way affects d, for the following reason:

The closing of K' completing, as it does, two inductive circuits to both of which K' is common, namely, K', G and C on one side and K' R and C' on the other, when a balance has been effected, that is to say, when $G : R :: C' : C$, K' becomes attacked, so to speak, by two discharges, which, being equal in potential but contrary in direction, neutralize each other, and so in no way affect G. Whereas, when a balance does not exist, that is to say, when G is not to $R :: C' : C$, one of the two discharges being of a higher potential than the other, the difference between the two is thus left unneutralized and is free to affect both inductive circuits, and thus to disturb G.

The direction of the consequent "*throw*" on G depends upon the *sign* of the discharge, which in its turn depends upon the nature of the adjustments of G, R, C and C'. Assuming C and C' to be equal if R be higher than G, the above mentioned difference would be, say *positive;* and the "*throw*" on G, say to the right of d. On the other hand if R were lower than G the reverse would happen.

Figs. 3, 4 and 5 illustrate the *rationale* of this galvanometer test under three different conditions of things:

1st. Where a balance has been made and $G = R$.
2d. Where a balance does not exist and where $R > G$.
3d. Where a balance does not exist and where $R < G$.
In all three examples $C = C'$.

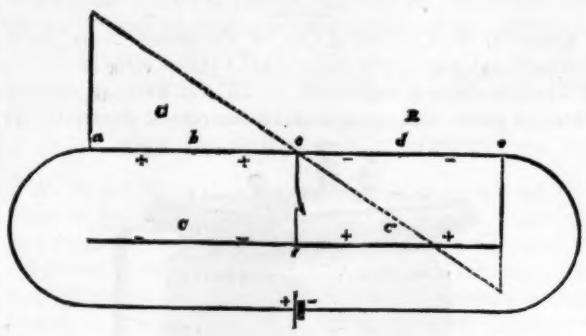


FIG. 3.

$a\,b\,c$ and $c\,d\,e$ represent G and R respectively.

C and C' represent two equal condensers, or, what is the same thing, one condenser equally divided.

Here $G = R$ and $C = C'$, so $G : R :: C' : C$.

The distribution of electricity consequent upon such an arrangement is shown by + and — signs.

The closing of K' connects points c and f, thereby not only forming two inductive circuits, but also producing two discharges in opposite directions, one neutralizing the other. This neutralization may here be represented by the equal number of + and — *signs* on either side of the points connected by K'.

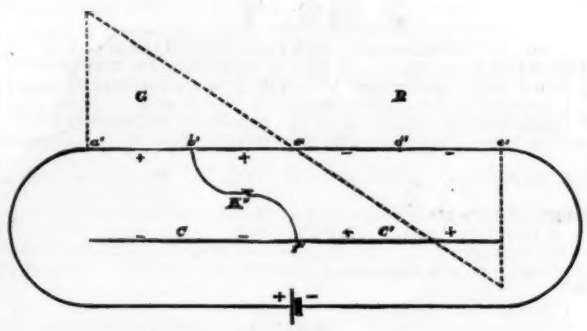


FIG. 4.

(Difference 2 +.)

$a'\,b'$ and $b'\,c'\,d'\,e' = G$ and R, respectively.

Here $G =$ but $\frac{1}{3}$ R, while $C = C'$; so in this case a balance does not exist, and upon the closing of K'', and the consequent connecting of points b' and f', one of the contrary discharges is at a higher potential than the other; so both inductive circuits are affected by the difference between the two potentials. In Fig. 4 this difference is represented by the two + *signs* which are left unneutralized on one side of points connected by K''.

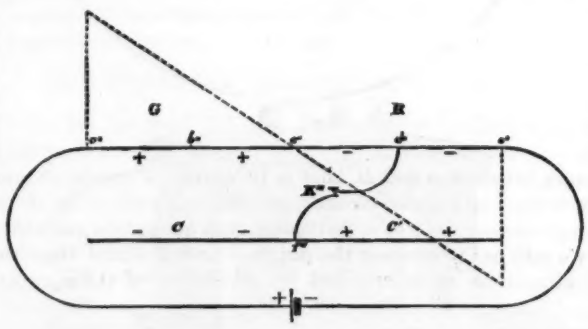


FIG. 5.

(Difference 2—.)

This case is the reverse of Fig. 4.

Here $G = 3R$, while $C = C'$, and the remaining unneutralized *signs* after closing of K''' and consequent connection of points d'' and f'' will be two —.

In Fig. 4, where $R > G$, the two inductive circuits, including the one containing G, are influenced by a discharge of 2+.

In Fig. 5, where $R < G$, a discharge of 2 — is the disturbing agent, so that, in these two cases, the "*throws*" on G are in opposite directions, and it is only when a balance exists, as in Fig. 3, that G remains undisturbed.

By the above method the writer has taken rapid tests of mirror galvanometers of a resistance ranging between 600 ohms and 5,200 ohms. The results checked by ordinary "*bridge*" tests with a second galvanometer have proved correct within one or two units. For the testing of a mirror galvanometer of the "water," "deadbeat" or ordinary "signaling" pattern, the only appliances necessary are an adjustable resistance and an office condenser; but when G is a sensitive testing galvanometer of the astatic pattern, an extra high resistance r (*vide* Fig. 2) inserted in the battery circuit becomes necessary for the producing of a convenient deflection within the limits of the scale.

It has been found requisite for both C and C' to be short-circuited for an instant after each attempt at a balance, and before a fresh adjustment is made, in order to dissipate the residual charge.

The following is the practical arrangement of the test:

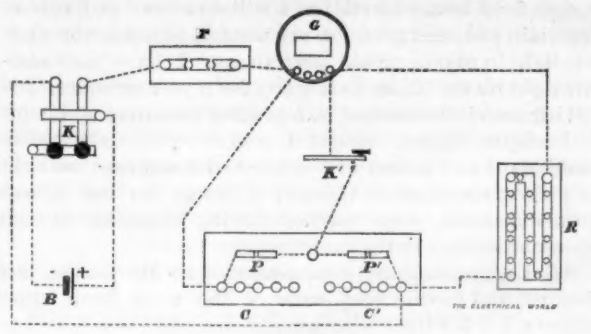


FIG. 6.

C and C' = an ordinary office condenser of say 20 micros divided as convenient, each side being short-circuited at pleasure at P and P'.

r = extra resistance inserted if necessary, but in no way influencing conditions of test already explained.

B = convenient battery.

K = battery key.

R = adjustable resistance.

G = galvanometer of unknown resistance.

Battery Test.

By making G and B change places, the resistance of B may be calculated by the proportion

$$B : R :: C' : C \text{ or } B = R\frac{C'}{C}$$

a balance being obtained, as before, by adjusting R until no disturbance is noticed on G's deflected spot, when K' is closed (*vide* Fig. 7).

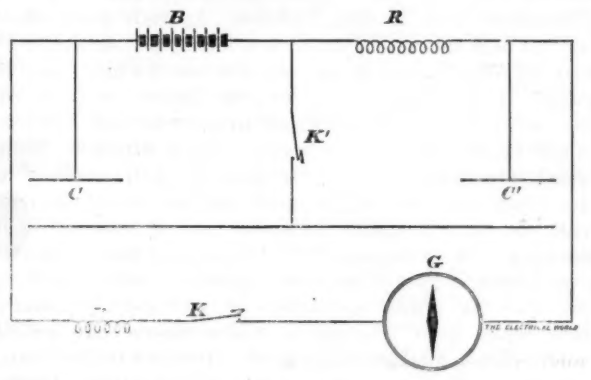


FIG. 7.

If necessary for the obtaining of a convenient deflection, an extra resistance r may be inserted with G without altering conditions of test. A shunt also may be used on G.

Vertical Engines for Electric Lighting.

The New York Safety Steam Power Company, 30 Cortlandt street, New York City, have quietly been making very substantial progress in the electric lighting field. They have been for fifteen years extensively engaged in the manufacture of vertical engines, and have, from the beginning of the electric light business, held the trade of many of the most prominent electric companies, so far as vertical engines have been required. The Edison Company for Isolated Lighting, the United States Electric Lighting Company, the Brush Electric Association of St. Louis, the Schuyler Electric Lighting Company, are each and all large buyers at the present time. The New York Safety Steam Power Company have recently brought out an "engine of the period"—this is to say, a compact, high-speed, horizontal engine. Several electric lighting plants are supplied with these engines, and they are claimed to be taking rank as second to none. The company build and carry in stock, ready for quick delivery, a good assortment of sizes, ranging from 12 to 150-horse power, and are ready to guarantee them to run for long periods under high pressure, high speed and heavy loads, in a smooth and noiseless manner, without heating or undue wear; and to be, to say the least, in comparison with any engine in the market, as economical in the use of steam, as capable per square inch of piston, as sensitive to change of load and as quick to adapt themselves thereto, as uniform and free from oscillation in speed per minute under varying resistauces, as perfect in construction and finish, as complete in details. They invite critical examination of their engines.

Some of their recent customers are the following: Brush-Swan Electric Co., Norfolk, Va.; Brush-Swan Electric Co., Washington, D. C.; Columbus Electric Light Co., Columbus, O.; Citizens' Electric Light Co., Joliet, Ill.; Sperry Electric Light Co, of Nebraska, Omaha, Neb.; Jenny Electric Light Co., Peoria, Ill.; The Forest City Electric Light and Power Co., Rockford, Ill.; Smith & McNell, 199 Washington street, New York City; D. Williams, 83 Reade street, New York City; R. J. Dean & Co., 504 Greenwich street, New York City; H. Lockwood, 126 Duane street, New York City; Arbuckle Bros., Brooklyn, N. Y.; E. Aaron & Co., Stapleton, S. I.; Star Coal Co., Streator, Ill.; Chicago Corset Co., Aurora, Ill.

The American Electric and Illuminating Company.

The annual meeting of the American Electric and Illuminating Company was held on May 24, at Portland, Me. and the following board of directors was chosen by a unanimous stock vote of about 86,000 shares, out of the total of 100,000: Silas Gurney, proprietor of Tremont House, Boston; Loren N. Downs, General Manager New England Telephone and Telegraph Company, Boston; H. S. Collins, banker, Collinsville, Conn.; H. P. Frost, General Manager Southern New England Telephone Company, New Haven, Conn.; Edward H. Goff, Boston; Payson Tucker, General Manager Eastern and Maine Central railroads, Portland, Me.; the Hon. Joseph R. Bodwell, President Hallowell Granite Company, Hallowell, Me.; Charles B. Whiting, banker, Worcester, Mass.; R. M. Kimball, Special Agent United States Treasury, Boston; Dr. J. G. Graves, Nashua, N. H.; Henry Colony, Treasurer Cheshire Mills, Keene, N. H.; H. E. Irvine, General Manager the Royal Electric Company, Montreal, P. Q.; William E. Hodgkins, of Charles A. Smith & Co., Boston. F. Montague Sowden was elected treasurer and clerk, and Clarence Hale, of Portland, assistant clerk. The directors of last year submitted a long report detailing the history of the company, the growth of its business, and its plans for the future. The increase in the business is reported steady and gratifying. The reduction in the cost of carbons, wire, machinery and other necessaries, through sharp competition, has brought the business to a profitable commercial basis, and a new contract with the manufacturers of the patented machinery used, ceding the sole rights to introduce the Thomson-Houston system in nearly the entire United States, gives promise of a great increase in volume and profit of business in the future. The directors say "Considering the amount of business already done and now in progress the paid capital of this company is very small in comparison with that of other corporations engaged in similar work, and is altogether inadequate to permit any considerable extension. To construct and place in operation electric-lighting plants requires the use of a large amount of money for a time, while the local lighting companies are being organized, and before returns can be received from them for the purchase of plants. Your directors, therefore, believe, that, in order to gain the full benefit of increased profits from the augmented business of the company, and to permit the immediate construction of lighting-plants in several important cities, from which demands have come for the introduction of our system, an increase of your capital should be authorized to a sufficient sum to provide for these prospective requirements." In accordance with this suggestion, a gradual increase in the volume of the preferred stock, as fast as needed for this extension of business, up to $750,000 was authorized, with the proviso that the right to subscribe for the new stock shall be given only to present stockholders, up to June 10. The statement of assets and liabilities at the close of the fiscal year, April 30, is as follows:

ASSETS.		
Due in cash from sub-companies, secured by collaterals		$154,645.09
Stock in sub-companies constructed		248,277.37
Bills and accounts receivable		29,564.84
Due from sub-companies under organization		971.60
Merchandise and plant		15,921.22
Real estate in Portland	$13,941	
Less due on same	11,000	
		2,941.00
Office furniture and fixtures at home office and sub companies		4,000.00
Cash on hand		5,128.40
LIABILITIES.		
Capital stock, preferred		$250,000.00
Bills payable		9,823.20
Accounts payable for construction, etc.		35,282.85
Due on purchase of Canada business, payable in monthly payments of $2,000 each		30,000.00
Surplus		136,343 47
	$461,449.52	$461,449.52

Codes for Cabling.

The subject of cabling is now of general interest, and a great deal of matter is being published on the subject. The following has appeared recently as to the use of "codes" for cabling purposes.

The only practical way to economize in cabling is for correspondents to adopt a simple code system, by which two or three words mean a great deal. At 50 cents a word a very small message is quite expensive. When the first line was opened, in 1860, the tariff was as high as $100 for 20 words or less, and it was not until some years later that the word-rate was adopted, and only for about a year has the rate been as low as 50 cents per word. The code system has both the advantages of economy and secrecy. "Code making, as a business, has grown up within the last ten years," said a gentleman who has adopted it as a profession. "The use of codes for ordinary business purposes dates from the beginning of ocean telegraphy, but people at first got up their own codes. It is a very easy thing to do, apparently. All you have to do is to make a list of phrases which you have frequently to use in your business and represent them by a corresponding list of single words. But people found that words are apt to be changed in telegraphic transmission into words whose telegraphic notation is similar. The result has sometimes been disastrous. Code makers made avoidance of such liability to error a special study. Then, too, code makers can attain a condensation of expression that makes their work far cheaper than any simple code such as a business man might get up for himself. Hence, large houses are willing to pay well for having codes made for them. There are houses spending as much as $30,000 a year for telegraphic advices, and a system which will put their messages into few words effects a very great saving for them.

Code makers keep the details of their work secret, but the principle upon which codes are constructed is easily understood. The range of all staple business transactions has limits, and, as a rule, closely confined limits. The aim of the code maker is to classify phrases which shall express the constantly recurring details of the market for any staple, and to denote each of its phrases by a word. Another object is to use one word so as to convey several meanings. This is done by arranging market details above the tops of columns of words and prices, quantities of any other information along the side. A word in the table expresses the phrase at the top of the column and also the phrase at its side. The compilation of a code is a very laborious task, but its value as an aid to business communications is indisputable. Sometimes queer sentences result from the chance grouping of code words. Not long since a tea house got this: "Unboiled babies detested."

DEPARTMENT OF INQUIRIES.

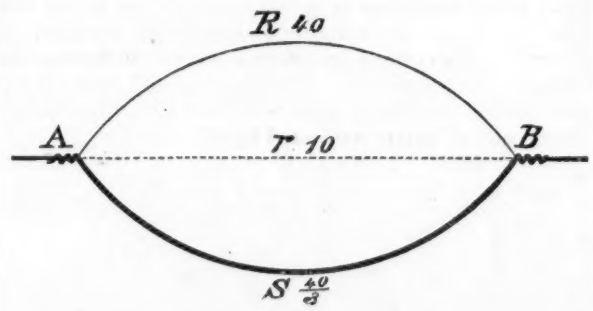
While we are pleased to answer in this department all questions of general interest to our readers, and do so without charge for time or expense, we must request those of our patrons who desire information for their personal interest, and who cannot be properly answered in this way to send us with their request a small sum, say from $1 to $5, to pay for the time and the expense incurred for their exclusive benefit.

65.—THOMPSON'S RHEOSTAT.

I have intended to construct a rheostat, and the article on page 153 of the ELECTRICAL WORLD is interesting on that point, but I do not fully understand it. Will you please explain in your "Department of Inquiries" how to do it? It says: "First cut off a length of wire and calculate the resistance which, as a shunt to its resistance (R) will give the final resistance (r) which is required. Let the resistance of this shunt be s then $S = \frac{Rr}{R-r}$. A second length of wire giving approximately this resistance (S) (say 2 per cent. more), is then cut off and the ends of it soldered to the ends of the first piece. The joint resistance is equal to the resistance r required. If you understand it please make it clear. I don't see it.' S. C. D.

CHATTANOOGA, Tenn.

The fault is in the description being too condensed. We will consider a case in order to make the matter clear. Suppose that it is desired to make the resistance between A and B 10 ohms in two paths. We will cut off the length of wire R, and measure its resistance and find it to be 40 ohms. Let the dotted line r represent the desired resistance between A and B, that is 10 ohms. Consider R and r as the two parallel circuits constituting a shunt s. S we will consider as to the resistance of a second wire which we will use to connect the points A and B; and that the value of S is determined by reduction of the equation $S = \frac{Rr}{R-r} = \frac{40 \times 10}{40-10} = \frac{400}{30} = \frac{40}{3}$. Now this second wire S is joined to the first wire R at the points A and B, forming a combined shunt s which has the required resistance r of ten ohms, as will be seen by working out the formula for determining the resistance of two derived circuits, namely, $\frac{Rr}{R+r} =$, as expressed in the diagram, $\frac{RS}{R+S} = \frac{40 \times \frac{40}{3}}{40 + \frac{40}{3}} = \frac{\frac{1600}{3}}{\frac{160}{3}} = \frac{1600}{160} = 10$ ohms, the desired resistance. In practice resistances of R and S will be more nearly equal, but we used the more unequal quantities to make the illustration the more forcible.



66.—ELECTRIC LIGHT MACHINES.

"Will you inform me where I can get one of the new electric light machines—I don't know the name of them, but they are said to be adapted for private houses, stores, etc., and are said to be very good, and are sold cheap?" G. A. S.

SELMA, Ala.

Electric light is adapted for houses, stores, etc., but the machines used for supplying the lamps must be run by some motor like a steam or gas engine, or water power. Unless used on a considerable scale, the light so produced is not economical. Write for particulars as to machines to some of our advertisers. Mere toys, such as batteries for producing incandescent platinum wires, are of no practical use in lighting.

67.—GOLD AND STOCK TICKERS.

"Please tell me where I can find a description of the ticker, or Gold and Stock Exchange printer? Something which will explain the principle and working of the instrument." F. P. J.

BUFFALO, N. Y.

Prescott's "*Electricity and the Electric Telegraph*," price $5, will give you the information.

68.—TELEPHONE TRANSMITTER.

"I have a very loud speaking transmitter. Is there any way of testing it for *long distance* without using an out-door line? In other words, would spools of wire of high resistance, such as induction coils, with telephones in circuit, and a resistance equal to 1,000 miles of telegraph line be of any practical value as a test? It is difficult to get the use of a line to try anything new, unless one is on intimate terms with high officials." J. S. W.

SUSPENSION BRIDGE, N. Y.

Those skilled in tests of telephones say that a test through high resistance coils is of little or no practical value, because the conditions are not the same as are encountered in long aerial lines. Some of these conditions are leakage, induction from neighboring lines and from earth currents, etc, etc. Maybe some of our readers will offer to you the suitable facilities for making the test of your instrument.

THE TELEGRAPH.

LONDON TO CALCUTTA.—The editor of the London *Telegraphist* recently enjoyed direct metallic communication with Calcutta from London over about 7,000 miles of wire. The Morse signals were excellently clear, and were transmitted at a speed of about 12 or 14 words per minute.

A PIONEER CABLE CAPITALIST.—The death is announced, by telegraph from England, of Mr. Alfred Field, an Englishman, who was at one time actively engaged in business in this city. He was greatly interested in the laying of the second Atlantic cable, and the contract for the material was signed in his house at Birmingham.

N. Y. MUTUAL TEL. CO.—At the annual election, on May 27, of the New York Mutual Telegraph Company, the following named gentlemen were chosen Directors: John G. Moore, George F. Baker, George S. Scott, H. C. Fahnestock, Jay Gould, Russell Sage, George William Ballou, George G. Haven, George J. Gould, and C. F. Peck.

THE BUSINESS MEN'S UNION.—At least one hundred dry goods, drug and general manufacturing firms in this city have banded themselves together in the Traders and Travelers' Union, a co-operative organization, whose object it is to fight for low rates for merchants in telegraphy, freighting, etc., and for the correction of monopolistic abuses of any and every kind affecting trade.

PETITIONS AGAINST POSTAL TELEGRAPHY.—The efforts of the telegraph companies to prevent Congress from passing any measure for the establishment of a postal telegraph system have begun to bear fruit, as a large number of petitions have been received by Congress from various parts of the country asking that the Government should not be given control of any telegraph system. In presenting to the Senate such a petition from citizens of Springfield, Mass, Senator Dawes remarked that in order that the American people might not be exposed to the dangers of a monopoly, the petitioners asked that the telegraph business might be left just as it is.

DANISH CABLE INTERESTS.—The Great Northern Telegraph Company, of Copenhagen, which held its meeting at the Danish capital, has now, says the *Pall Mall Gazette*, 17 cables, with a total length of 6,162 nautical miles. It was mentioned as an illustration of the extent to which political events affect the receipts of telegraph companies, that last year they had earned £30,000 more than in 1882, owing to the exceptional correspondence caused by the Franco-Tonquin war. Judging from all appearances, the Eastern Telegraph Company ought to expect considerably increased business this autumn on account of the threatening aspect of affairs in Egypt. This reminder of the success of the Great Northern Telegraph Company will confirm the suspicion that after all there may be something in the story of the proposed new American cable, which is to start from Denmark and proceed westward via Iceland and Greenland.

THE TELEPHONE.

BELL REVENUE.—It is said that the last month's revenues of the Bell Company were the largest in its history.

TO BE DESIGNATED BY NUMBERS.—Lynn, Mass., telephone subscribers are, within a few days, to be designated by numbers, instead of names as now. There are now about 600 subscribers to the Lynn service.

MARRIAGE BELLS.—Mr. E. M. Goodwin, the popular manager of the Terre Haute, Ind., Exchange, has married Miss Mabel Newcomb, daughter of the late Judge Newcomb, well known throughout Indiana.

OUTPUT OF BELL TELEPHONES.—The output of telephones for the month ended May 20 was 5,023, against 6,763 in 1883, making a total of 12,758 for the three months of the fiscal year, against 18,844 in like months last year.

GROWTH IN MEXICO.—The Mexican Company has 514 instruments in use in the City of Mexico, 200 in Guadalajara, and will soon have 100 more on the outside line to Ameca. The company is now the owner of the Les Andres, Watson, Berliner and Bell & Blake patents and rights to patents for the republic of Mexico, and has lately acquired by act of the Mexican Congress the exclusive right to import telephonic material into the republic, the exclusive right to erect poles in the federal district of Mexico and the exclusive right to transact the telephone business in said district—these several concessions running ten years. Furthermore, the terms have been agreed upon for a new contract for instruments with the American Bell Company, the latter to sell to the former exclusively for a period of three pears.

NARROW ESCAPE FOR TELEPHONE OPERATORS.—A fire broke out on the morning of May 24, in the building of the Toronto, Can., *Mail*, starting in the basement, and spreading upwards by means of the elevator shaft. In the seventh story, in the telephone office, fourteen girls were operating at the time of the fire, and, not being notified when the fire broke out, they only

became aware of their danger when retreat by the stairs was cut off. Ten of them crept out on the stone ledge on the sixth story of the building. Here one of them fainted, and was only preserved from falling a distance of eighty feet to the ground by her courageous companions. Most of the other girls, some of whom were quite young, knelt on the stone cornice for a space of twenty minutes before they were rescued by the firemen with their hook and ladders. The telephone company is the heaviest loser, and it will take fifteen days to repair the damage.

THE ELECTRIC LIGHT.

J. P. DIETER, of Chillicothe, O., has for some months been acting as Ohio State Agent of the Thomson-Houston Company.

A BRUSH PLANT AT CHILLICOTHE, O.—An electric light company has just been organized at Chillicothe, O., by C. C. Curtis general agent of the Brush Company, and it started a 45-light plant successfully two weeks ago.

AN ABLE REPRESENTATIVE.—Dr. E. M. Avery, general agent of the Brush-Swan Company, has recently scored three more triumphs for his company, namely, at Binghamton, N. Y.; Trenton, N. J., and Geneva, N. Y., receiving orders for over two hundred lamps and dynamos to run them.

PREPARING FOR ELECTRIC LIGHTS IN BROOKLYN.—Charles Cooper & Co., who have received a franchise for carrying on the business of electric lighting in the Eastern District, have prepared the bond to be given the city. The amount is $25,000. Arrangements have been made to place one public electric light at the junction of Broadway and Fourth street, and another at the Bedford avenue fountain. It is supposed that the bond, and that for $50,000 of Pope, Sewall & Co., who are to light the Western District, will be filed this week. Evidently not many days will elapse before the introduction of electric lighting in the city will become general.

BINGHAMTON, N. Y.—A meeting of the organizers of the People's Electric Light Company was held at Hotel Bennett on May 22, and in accordance with the arrangement by which they secure certain rights, they decided to change the name to the Brush-Swan Electric Light Company, of Binghamton, N. Y. The directors of the company, Messrs. Charles Davis, Fred Bennett, Clark Z. Otis, Watson Heath and John Rankin, then proceeded to the election of officers of the new organization as follows: President, Charles Davis; Secretary, Fred. Bennett; Treasurer, Fred. E. Ross; General Manager, John Anderson. The capital stock has been increased from $50,000 to $100,000, and a plant of ninety Brush lights has been ordered.

LIGHT FOR EAST BOSTON.—The American Electric and Illuminating Company has, says the Boston *Herald*, concluded arrangements with Mr. David H. Blaney, of East Boston, acting in behalf of the Shaw heirs of New York, for the purchase of the William Woolley wharf on the northerly side of Condor street, adjoining the Meridian street bridge, for the establishment of a plant in East Boston. The company is to erect a central lighting station with a capacity of 200 or 300 lights of the Thomson-Houston system. A special company is now forming under the name of the Union Electric Light and Power Company. Wires are to be run to the business centres of East Boston and Chelsea, and the business and plant will be placed in the hands of the new company as soon as completed. A large number of subscriptions have already been received for the stock, and it is said that at least 100 lights have already been secured by East Boston parties alone.

MISCELLANEOUS NOTES.

RECOGNIZING THE SERVICES OF MARCEL DEPREZ.—At its sitting of May 5, the French Academy of Sciences awarded to M. Marcel Deprez, the Fourneyron prize, which, in accordance with the decision of last year, was to be given to the scientist making the greatest progress in the electrical transmission of energy.

AN ELECTRICAL EXHIBITION AT BRUSSELS.—A provisional committee has been formed at Brussels to organize an Electrical Exhibition there. It has been decided to hold the Exhibition in 1887, so as not to clash with the intervening Exhibition at Antwerp, in which electricity will form a large and important section.

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Wednesday at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—Am. Cable, a 52; American Rapid, b 50, a 65; B. & M. Co., a 50; Commercial Telegram Company Pref'd, a 109; Commercial Telegram Common, a 95; Harlem District Telegraph Co., b 2, a 2.50; Manhattan Telegraph, b 10, a 85; Mexican, b 125, a 147; Postal Telegraph (stock), b 4.25, a 4.75; Postal Telegraph Bonds, 1st, 6 per cent. b 44, a 48; W. U. b 57 a 58.

Telegraph stocks have generally been stronger during the week.

A London dispatch says the present pool of Atlantic cable companies is organizing for better competition against the Bennett-Mackay enterprise. There are four companies in the pool—French, Direct, Anglo and American—and they announce that they have agreed to open competition with the uniform rate of 3 pence, or 6 cents per word, as soon as the new cable is opened.

TELEPHONE.—American Bell, a 155; American Speaking, b 110, a 125; Currier Telephone Bell, b 3; Colombia and Panama, b 24 50, a 25.75; Continental, b 15; Dolbear, b 5, a 10; Globe b 3.25, a 6; Hudson River, b 60, a 90; Inter-Continental, b .95, a 1.25; Mexican Central, a 2.50; Missouri & Kansas, a 10; Molecular, a 9; New York, a 85; New York and New Jersey, a 80; New York and Pennsylvania, b 50, a 80; New York State Overland, b 15, a 20; Overland, b 10, a 12; People's, b 9, a 11; People's (N. E.), b 1, a 10; Solenoid, a 90; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, b 2, a 2.50; West India Telegraph and Telephone, b 1.25, a 1.50.

The Boston *Advertiser* of May 27 thus quotes the local market: In telephone stocks, Bell advanced ⅛ to 154; New England ¼ to 26¼; Erie was steady at 25.

ELECTRIC LIGHT.—American, b 2, a 4; Baxter, b 23, a 25; Brush, b 50, a 80; Brush Illuminating, b 45, a 70; Daft, a 90; Edison, b 50, a 100; Edison Illuminating, b 55, a 75; Edison Isolated, a 90; Edison European, b 8, a 15; Excelsior, b 20; Swan Incandescent, b 15, a 40; United States, b 75, a 95; United States Ill. Co., a 90.

Kohlsaat & Co., No. 30 Pine street, furnish the following quotations for miscellaneous securities:

	About.		About.
U. S. Electric Light	100	Harlem Dist. Tele	75
People's Tele	20	Postal Telegraph	6
N. Y. Mutual Tele	44		

BUSINESS NOTICES.

THE CUMMER ENGINE.—"Another proof of the superiority of the Cummer automatic engine," say the makers, "lies in the fact that the Pennsylvania R. R. Co. have just placed their order with the Cummer Engine Co. of Cleveland, and this was done after a thorough investigation of the various automatic engines by their best experts, who visited the different manufactories and examined the engines in operation and in course of construction. The Pennsylvania R. R. Co. thoroughly investigate the merits of everything they purchase, even down to the least; nothing but the best of everything enters into their consideration and adoption: therefore, the importance of having nothing but the best automatic engines caused that company to have the engine business thoroughly investigated by two independent sets of experts, and the fact that both sets reported in favor of the Cummer engine is quite a feather in the Cummer Engine Co.'s cap, and one that they may well feel proud of."

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 9 Murray Street, New York.

PATENTS DATED MAY 13, 1884.

Apparatus for Lighting Gas by Electricity; Le Roy S. White, of Waterbury, Conn., Assignor to the Electric Appliance Co. of same place..... 298,531
Various details in the construction of automatic electric gas-lighting burners.

Electro-Magnetic Motor; Chas. A. Saxe, of Philadelphia, Pa..... 298,507
The movements of dogs attached to the armatures of the electro-magnets by engaging the teeth of ratchet-wheels effect rotation. The circuits are made and broken by the vibratory movements of the armatures.

Electric Eye-Shade.—Louis K. Oppenheimer, of Cincinnati, O., Assignor to Simon Lindeman, of same place..... 298,397
Consists in combining and arranging upon the shade one or more simple galvanic piles with suitable insulated connection and electrodes arranged to rest against or in the region of the temples.

Element for Storage Batteries; Willard E. Case, of Auburn, N. Y..... 298,348
"An element or electrode composed of an amalgam with mercury, of any lead alloy, containing a non-oxidizable metal, and having a lower fusing-point than lead alone; any substance capable of storing electrical potential in said battery, and any substance inert in said battery, and capable of occluding gases."

Electric Work-Indicator for Mills; Aaron D. Blodgett, of Boston, Mass..... 298,341
Consists in the combination, with a series of looms or other machines at one or more mills, and with the stopping and starting mechanism thereof, of a series of electric circuits and circuit-closers therefor—one for each loom—the circuit-closers being adapted to be operated by the movements made to start and stop the loom, and a recording apparatus located at a central point, and common to all the looms and circuits, whereby the working-time of each loom may be automatically recorded.

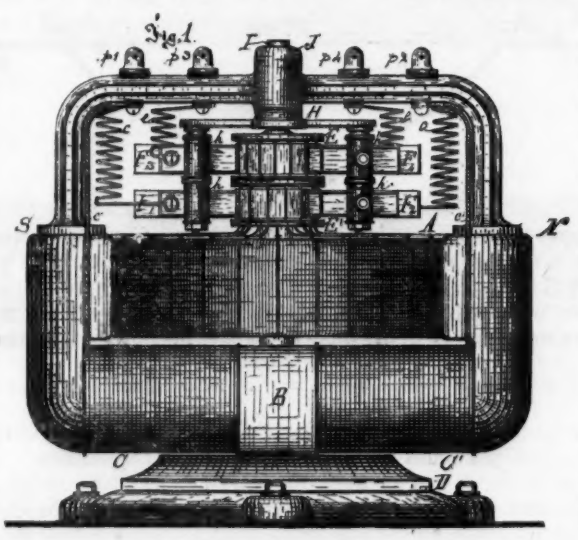
Individual Electric Call Apparatus; Albert P. Howes, of Worcester, Mass..... 298,383
Provides means whereby any one of several call apparatuses on one line may be sounded without affecting the others on the line; for signaling from any one to the central station without sounding the other calls, and also for signifying when the motor requires winding.

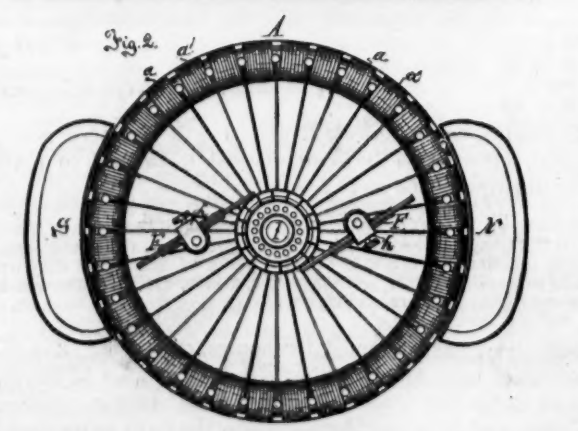
Insulator; Joseph Slater Lewis, of Birkenhead, County of Chester, Assignor of one-half to William Phillips Thompson, of Liverpool, England..... 298,593
A bolt with a threaded end is passed through the wooden arm or bracket; a sleeve is slipped on the bolt; a rubber ring is then put over the bolt and a washer on top of that. Then the insulator cup is screwed on the bolt, by means of a thread made in its socket to fit the thread on the bolt.

Lightning Conductor; Thomas H. Dodge, of Worcester, Mass..... 298,357
Consists, first, in the combination of the air-terminal of a lightning rod with the metallic wires of a barbed fence; second, in the combination, with the several wires of such fence, of a series of earth connections; third, in the combination, with the earth connections, of a mass or package of barbed wire.

Methods of Treating Carbons for Electric Lights; Thomas A. Edison, Assignor to the Edison Electric Light Co., of New York..... 298,679
Consists in subjecting the thickened ends only of the filaments, previously prepared, of carbon, to a high heat in vacuo.

Inductorium; Charles J. Van Depoele, of Chicago, Ill..... 298,431
This machine is especially designed to operate incandescent lights with currents of high tension, or such as are used to run arc lamps, and enables me to place a number of such generators





or inductoriums in circuit with arc lights. The current which is furnished in such circuit is used to rotate the armature of the inductorium, and said armature, as above stated, being wound with two independent sets of coils, one set is used to produce the motion between the poles of its field-magnet, while the other set is used to produce a current of lower tension with which to run incandescent lamps.

A represents the armature. *a* and *a'* are independent armature coils. *B* is the field magnet, provided with polar extensions *N* and *S*. *C* and *C'* represent the helices of said field magnet. *D* is the iron base supporting the machine. *E* and *E'* are commutators independent of each other. *E* is connected to the coils *a a*, etc., and *E'* is similarily connected to the coils *a' a'*, etc., of the armature *A*. $F' F^2 F^3 F^4$ are brushes bearing upon the commutators *E* and *E'*. *h h h h* are brush holders for the brushes $F' F^2 F^3 F^4$. *c c* and *e e* are copper conductors giving passage to the current to the inner and outer circuits of the machine. *H* is a cross-bar carrying the brush-holders *h h h h*. *I* is the shaft carrying the armature *A*. *J* is a bearing in which the shaft *I* is kept in place, and wherein it revolves. *N* and *S* are the north and south poles of the field magnet *B*, between which the armature revolves. $p' p^2 p^3 p^4$ are the binding-posts to the machine. *p* and *n* are the leads to the lamps.

Quadruplex Telegraph; George W. Gardanier, of Saratoga Springs, N. Y..... 298,571
Consists in a system for multiple transmission in the same direction in which the entire main battery at one or each station is always in circuit, in which three separate relays are employed for receiving or recording two independent sets of signals or messages, and in which the potential of the current may be varied without regard to its polarity, by reversing the poles of the smaller section of the battery with respect to the poles of the larger section thereof.

Regulator for Electric Motors; Charles G. Burke, of Richmond Hill, N. Y..... 298,550
Consists in applying to an electric motor, which is actuated by electric impulses transmitted through each of a series of actuating electro-magnets in succession, a device which may be so adjusted as to modify the duration of the successive impulses thus transmitted.

Skeleton Arch for the Support of Electric Wires.—George M. Hoag, of Evansville, Indiana... 298,692
Consists of a system of trussing.

Socket for Incandescent Electric Lamps; Sigmund Bergmann, of New York, N. Y..... 298,658
Consists in novel devices and combinations thereof.

Telephone Transmitter; Daniel Drawbaugh, of Eberly's Mills, Pa., Assignor to the People's Telephone Co., of New York..... 298,677
One electrode rests on the other by gravity. The contact surfaces are at an angle of about 45° from the horizontal.

Telephone Exchange Apparatus; Thomas B. Doolittle, of Bridgeport, Conn..... 298,559
Comprises certain improvements in details of construction of switch-boards, switches, and apparatus for establishing the connections between different lines, so that the same may be effected with the utmost convenience and celerity.

Terminal Insulator; Joseph Slater Lewis, of Birkenhead, County of Chester, Assignor of one-half to William Phillips, of Liverpool, England..... 298,594
A ring of insulating material has a circumferential groove to receive a clamp for attachment to any suitable support. The line wire passes through the ring, and is looped and fastened by binding the end onto the line.

Telephone Transmitter; Daniel Drawbaugh, of Eberly's Mills, Pa., Assignor to the People's Telephone Co., of New York..... 298,676
Consists in a construction and arrangement of parts whereby the transmitter, which is of the "carbon" class, is protected from the effects of jars and vibrations of the support to which it is attached, and at the same time is rendered fire-proof.